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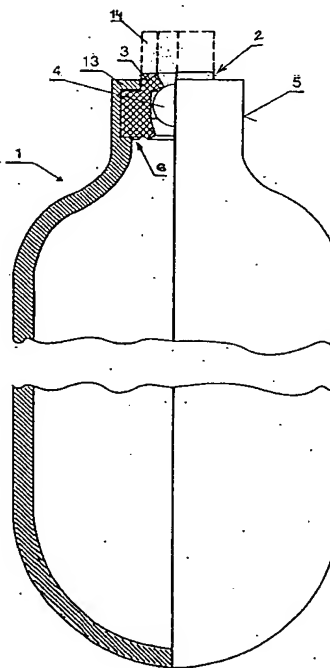
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(54) **Valve, applicable for use in single-use metal cartridges**

(57) Valve applicable for use in single-use metal cartridges (1) having a flanged or crimped closing, the valve (2) comprises a valve housing (3) and a ball valve accommodated therein. The diameter of said valve housing (3) is smaller than the inner diameter of a neck part (5) of the cartridge (1) on the lower part of said valve housing (3) intake ducts (6) are formed. The cartridge (1) is filled with gas through a bypath-gap which arises from the diameter difference and through the intake ducts (6). As soon as the valve housing (3) is pressed into the neck part (5) the cartridge (1) is hermetically sealed. If the valve housing (3) has a ring shaped top it accommodates an additional sealing area for a variety of pressure inlet valves. The ball valve comprises a ball path (7) having a diameter larger than a ball (4) accommodated therein, a lower ball cup (8) formed in the lower part of the ball path (7), and an upper ball cup (9) formed in the upper part of the ball path (7).

Fig. 2



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Description

[0001] The present invention relates to a valve, applicable for use in single-use metal cartridges for high pressure or liquefied gas e.g. for siphon or cream makers, the valve comprises a valve housing tightly fixable in a neck part of the cartridge.

[0002] Presently used methods for closing single-use cartridges of small (max. 210 ml) volume capacity suitable for commercial marketing of high-pressure or liquefied gas products (e.g.: CO₂, N₂O, O₂, Ar₂, N₂) are the following: welded closing; flanged/crimped closing where the closing element includes a resilient element (e.g.: O-ring); press-fitted metal plug made of a soft metal; and internal gas-pressure operated valve including resilient elements.

[0003] Opening of cartridges to be used having a welded closing is generally performed by piercing the welded metal closing element. For this a threaded cartridge holder is used in order to exert a proper piercing force. These cartridges will become empty immediately subsequent to piercing, even when exertion of this piercing force is ceased.

[0004] Also, in case of other closing methods in which a resilient closing element is used, opening of the cartridges is performed by piercing the metal closing element by means of a threaded cartridge holder and a piercing pin. A disadvantage of the single-use cartridges having resilient elements and which are valve operated with internal gas pressure (which can be opened without use of auxiliary devices) is that the valve pin stays in its place, therefore it is not perceptible whether the cartridge is filled or empty. The cartridge might be refilled with any kind of gaseous or liquid state material since filling is also performed through the closing element (valve) accommodated in the cartridge according to the state of the art. If the resilient elements are generally made of a plastic material, the closing of the cartridge becomes unreliable when the temperature is too high (e.g.: above 70°C), for example when the cartridges are stored in a place which is exposed to sunshine.

[0005] Various embodiments of the above mentioned solutions are known for example from CH 596493 A, GB 2190478 A and EP 0 525 449 A1.

[0006] EP 0 867 656 A1 describes a cartridge having a hollow body with orifice sealed by a check valve. The valve has a valve body, sealed to the hollow body, with a longitudinal bore, in which a valve pin is accommodated. The valve pin has a thickened truncated cone-shaped end of the side of the hollow body which interacts with a complementary-shaped construction in the bore in a first position. In a second limit position, the pin abuts a stop formed by a projection into the longitudinal bore. The problem is that with this embodiment refilling of the cartridge is not prevented. Further, machining of the valve pin and the bore is very complicated since these components are formed from a surface treated (ground) cone or cylinder.

[0007] US 3 985 332 A describes a non-refillable safety valve for a pressure container. Realization of a safety valve of this kind is complicated considering that filling is also performed through the same, after which by means of a threaded closing element the valve can be placed in a position in which the possibility of refilling is prevented by a snap ring. This solution is too complicated and expensive in case of cartridges intended for simpler use.

[0008] Consequently, none of the known solutions can provide impossibility of refilling of the single-use cartridges, and/or these solutions require too much piercing force (approximately 170 N), and/or outflow of the gas from the cartridges can not be terminated before the cartridge is entirely discharged, and/or state of the cartridge (whether it is filled or empty) is not perceptible.

[0009] Consequently it is the main aim of the invention to create a simple valve for non refillable safety cartridges as e.g. siphon cartridges which allows filling of the cartridge without complicated features; thus minimizing technical troubles due to very few parts and reducing costs of product and filling process. In order to reach this aim a valve according to the above features is characterized in that the diameter of said valve housing is smaller than the inner diameter of the neck part thus defining a bypass-gap which allows filling of the cartridge before the tight friction setting and close fit of the valve housing in the neck part. The valve itself is used like a plug. The cartridge is not filled through the valve but along the outside of the valve housing, which is tightly fitted into the neck part of the cartridge as soon as the cartridge is completely filled. The material of the cartridge is harder than the material of the valve housing. A preferred embodiment of the invention is characterized in that on the lower part of the valve housing intake ducts; preferably radial grooves on the surface facing the inside of the cartridge, are formed adjacent to a shoulder in the neck part which ducts or grooves are flat pressed and eliminated by pressing in the valve housing in the cartridge neck part. These intake ducts allow the gas to pass through the gap which is kept open by the ribs following the grooves on the valve housing as long as the valve housing is not yet pressed into the neck part and fixed by flanged or crimped enclosure of the valve housing in the neck part. Due to the axial pressure on the valve housing, its material will flow and the housing will expand in its diameter thus closing the bypass-gap as well as the grooves. The result is a perfect and tight sealing of the valve in the cartridge.

[0010] A further embodiment of the invention is characterized in that the valve housing comprises a ball path having a diameter larger than a ball accommodated therein, a lower ball cup formed in the lower part of said ball path and an upper ball cup formed in the upper part of said ball path, said upper ball cup is formed from a flange being on said neck part of said cartridge or from the material of said valve housing. Though the complete valve can be pre fabricated it is also possible to use a partly

pre fabricated valve which receives its functionality by crimping the cartridge neck. The resulting bore must of course be smaller than the ball and the edge of the bore should be gas tight when the ball is pressed against this edge. It should be produced with a conical shape. This embodiment is an alternative to the upper ball cup which is part of the valve housing. Of course the length of said ball path allows free movement of said ball between the lower ball cup and the upper ball cup. For multi functional use it is of advantage that the valve housing has a ring shaped top as connecting sleeve for a plurality of inlet valves on siphon or cream makers or other pressure gas operated units. The customer has the advantage that this cartridge will fit on his bottle or unit anyway. The ring shaped top or sleeve accommodates an additional sealing area and creates a safety distance between the ball-valve and the piercing needle for a variety of different pressure inlet valves on the market e.g. in cream whippers, soda siphons or other applications. So the cartridge can safely be pressed into such inlet valves and the pressure will only be released from the cartridge if the ring sleeve seals against a frontal sealing means or if the neck of the cartridge seals against an O-ring. In order to clearly indicate and to identify used or refilled cartridges it is useful that a membrane covers the top opening of the valve housing or the cartridge as an indicator for non-used gas tight condition of the valve.

[0011] Accordingly, the present invention eliminates the disadvantages of the known closing methods for cartridges filled with liquefied gas or gaseous material, that is also, to lessen the force required for piercing the cartridge to 20-40 N, so that the user will be able to open the filled and sealed cartridge by hand-power without using any auxiliary devices. An empty state (subsequent to use) of the cartridge is perceptible, and the emptied cartridge is prevented from being refilled. If intended a discontinuous outflow of gas is possible.

[0012] A more detailed description of the valve according to the invention will be given with reference to the accompanying drawings, in which:

Figure 1 is the side cross-sectional view of the valve accommodated in the neck part of the cartridge, the broken lines show the two static position of the ball. Figure 2 is the side view of the filled, ready-for-use cartridge and valve in partial cross-section, with a multi functional connection sleeve in broken lines. Figure 3 is a side view in partial cross-section showing the first stage in assembling the valve. Figure 4 is a side view in partial cross-section showing the second stage in assembling the valve. Figure 5 is a side view in partial cross-section showing the valve accommodated in a cartridge, and the process of filling the cartridge. Figure 6 is a side view in partial cross-section showing the neck part and the valve of the filled up and flanged/crimped cartridge. Figure 7 is a side view in partial cross-section showing

ing the cartridge during discharging, with the ball in its dynamic position.

Figure 8 is a bottom-view showing the cross-section taken along line VIII-VIII of the cartridge of figure 1. Figure 9 shows the neck part of the filled up cartridge viewed from above.

Figure 10 is a partial cross-section showing the two steps taken during forming the upper ball cup formed from the flange of the neck part of the cartridge, wherein the broken line represents the flange resulting from the second step of the process.

[0013] The valve 2 according to the invention applicable for single-use metal cartridges 1 has a crimped or flanged neck part 5 which encloses a valve housing 3 of a ball valve accommodated therein provided with a ball 4 (figure 2). Prior to the tight friction setting of valve housing 3 in the neck part 5 the diameter of the valve housing 3 is preferably 0.3 mm smaller than the inner diameter of the neck part 5 of cartridge 1 (figure 5). In the lower part of the valve housing 3 intake ducts 6 or grooves and ribs are formed. The ball valve comprises a ball path 7 having a diameter preferably 0.3 mm larger than the ball 4 accommodated therein; a lower ball cup 8 formed in the lower part of the ball path 7; and an upper ball cup 9 formed in the upper part of the ball path 7 (figure 4). The upper ball cup 9 is formed from the material of the valve housing 3 (figure 4) or from the flange 13 being on the neck part 5 of the cartridge 1 (figure 10). Valve 2 is accommodated in the neck part 5 of the cartridge 1, and is pressed in by applying cold pressing as soon as the cartridge 1 is filled with pressure gas or liquid. Therefore cartridge 1 is formed from a material harder than the material of the valve housing 3. In order to assure proper operation of the valve, the length of the ball path 7 is chosen in such a way (e.g.: 0.5 mm) that free motion of the ball 4 is ensured between the lower ball cup 8 and the upper ball cup 9 (figures 1 and 10). In an advantageous embodiment a closing element 10 is secured onto flange 13 to make the state of the cartridge 1 (whether filled or empty) more perceptible (figure 5). Valve needle 12 of drain valve 11 serves for discharging of cartridge 1. (fig. 7)

[0014] To make use of cartridge 1 provided with valve 2 the following steps are taken: completion of valve 2; putting it into cartridge 1 with clearance; charging with gas through bypass-gaps between valve housing and cartridge neck and sealing of cartridge 1 by friction setting of the valve housing e.g. pressing in the valve housing into the cartridge neck; and the consumer takes out the gas by opening the ball valve, thus discharging the cartridge 1.

[0015] As a first step during manufacture of valve 2, valve housing 3 is formed from a material (for example aluminium) softer than the material of the cartridge 1 (e.g. steel) by using known methods, for example chipping (lathe work) or pressing. Then intake duct 6 (grooves)

is formed in the lower part of valve housing 3 by means of a crimper (pressing) or by chipping. In a following step ball path 7 and upper ball cup 9 (figure 3) are bored. In the embodiment of figure 10 the upper ball cup 9 is formed from flange 13 of the cartridge 1. In this case ball path 7 is a simple through-bore, and lower ball cup 8 may be flanged or crimped without placing ball 4 into ball path 7. In the embodiment shown in figure 3, ball 4 is placed into ball path 7, and the lower edge of the ball path 7 is bent by flanging (figure 4). In this manner, valve 2 is ready for use. Valve 2 is positioned into the neck part 5 of cartridge 1 with a bypass-gap around then cartridge 1 is charged with pressure gas or liquid through the bypass-gap by means of a known charger. The valve is shown under pressure in figure 5. The medium to be filled into cartridge 1 flows through the interstice or bypass-gap between the valve housing 3 of valve 2 and the neck part 5, and through intake ducts 6 or grooves. When the cartridge 1 is completely filled, flange 13 is pressed onto the valve 2 (for example by using cold pressing). Then the valve housing 3 formed from a softer material than the material of cartridge 1 is submitted to flowage, and intake ducts 6 as well as interstices or bypass-gap between valve housing 3 and neck part 5 close up due to material deformation. Ball 4 will lean against upper ball cup 9 due to the pressure existing inside cartridge 1 (figure 6).

[0016] In the embodiment according to figure 10, subsequent to bending of flange 13, ball 4 will lean against upper ball cup 9 so formed by flange 13. In this embodiment care must be taken of keeping the ball 4 in ball path 7 during charging, in order to maintain the gas pressure in valve 2 which exists inside cartridge 1 until flange 13 is bent. This can not be a problem for those skilled in the art. Then, if needed, closing element 10 may be secured over the top opening of the valve 2 or to flange 13 of the filled up cartridge 1 by using one of the known methods. The function or purpose of closing element 10 is the sealing the original untouched condition and to make the state of cartridge 1 (whether it is filled or empty) noticeable.

[0017] Discharging of cartridge 1 may be performed as it is shown in figure 7, where drain valve 11 (preferably provided with a rubber or plastic seal) is coupled to the neck part 5 of cartridge 1 in a form fitting manner, and by means of valve needle 12 the ball 4 is forced to move against the pressure existing in the cartridge 1 to such an extent that content of cartridge 1 to be discharged is enabled to flow through lower ball cup 8, ball path 7 and upper ball cup 9. Also, cartridge 1 provided with valve 2 according to the invention can be emptied discontinuously in steps. Naturally, the length of valve needle 12 must be measured out so that ball 4 does not lean against the lower ball cup 8 when it is forced to move against the pressure existing in the cartridge. If cartridge 1 is provided with a closing element 10, then it is pierced by valve needle 12 prior to its reaching ball 4. Charging of cartridge 1 can be performed only in a

position with the neck part 5 standing upwards. Consequently, recharging of an emptied cartridge 1 is prevented by ball 4 because in charging position it lies on lower ball cup 8 since it is not forced by the gas pressure into the upper ball cup 9. Filled or emptied state of cartridge 1 is clearly indicated by the position of ball 4.

[0018] The advantage of the single-use valve applicable for cartridges having a flanged/crimped closing according to the invention is that it can be opened (pierced) by exerting only a slight force, without use of auxiliary devices, and when pierced, it is distinctly visible that it has already been used and is not suitable for recharging. An other advantage is that discontinuous discharging of the cartridges according to the invention is also enabled.

[0019] A sleeve 14 is formed as a ring shaped top as part of the valve housing 3 which allows to connect the cartridge 1 to a variety of inlet valves of various types of siphon bottles or cream makers or other units which are operated by pressure gas or liquid. The inlet valve consists of a back pressure valve and a pin which removes the ball 4 a little (as shown in fig. 7).

Claims

1. Valve, applicable for use in single-use metal cartridges (1) for high pressure or liquefied gas e.g. for siphon or cream makers, the valve (2) comprises a valve housing (3) tightly fixable in a neck part (5) of the cartridge (1) **characterized in that** the diameter of said valve housing (3) is smaller than the inner diameter of the neck part (5) thus defining a bypass-gap which allows filling of the cartridge before the tight friction setting and close fit of the valve housing (3) in the neck part (5).
2. Valve according to claim 1 **characterized in that** the cartridge (1) is formed from a material which is harder than the material of the valve housing (3).
3. Valve according to claim 1 and 2 **characterized in that** on the lower part of the valve housing (3) intake ducts (6), preferably radial grooves on the surface facing the inside of the cartridge (1), are formed adjacent to a shoulder in the neck part (5) which ducts or grooves are flat pressed and eliminated by pressing in the valve housing in the cartridge neck part (5).
4. Valve according to claims 1 to 3 **characterized in that** the valve housing (3) comprises a ball path (7) having a diameter larger than a ball (4) accommodated therein, a lower ball cup (8) formed in the lower part of said ball path (7) and an upper ball cup (9) formed in the upper part of said ball path (7), said upper ball cup (9) is formed from a flange (13) being on said neck part (5) of said cartridge (1) or from

the material of said valve housing (3).

5. Valve according to claim 4 **characterized in that** the length of said ball path (7) allows free movement of said ball (4) between lower ball cup (8) and upper ball cup (9). 5
6. Valve according to one of the claims 1 to 5 **characterized in that** the valve housing (3) has a ring shaped top as connecting sleeve (14) for a plurality of inlet valves on siphon or cream makers or other pressure gas operated units. 10
7. Valve according to one of the claims 1 to 6, **characterized in that** a membrane covers the top opening of the valve housing (3) or the cartridge as indicator for non-used and gas tight condition of the cartridge. 15

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Fig. 1

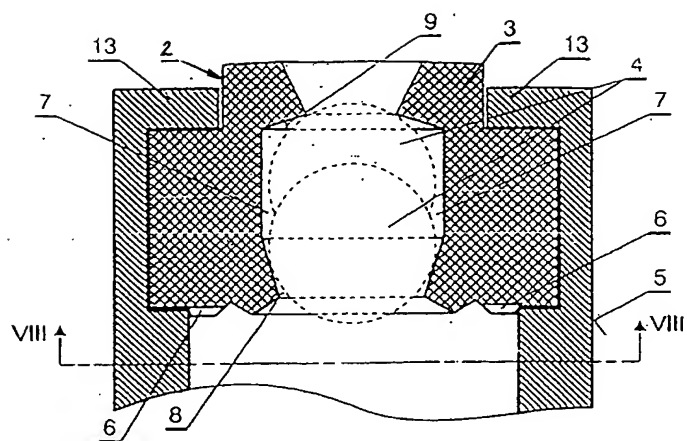


Fig. 2

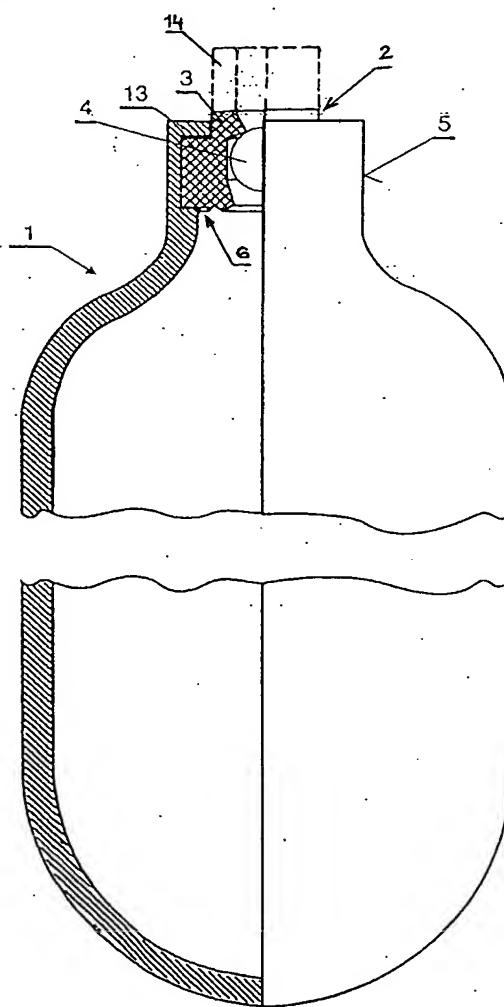


Fig.3

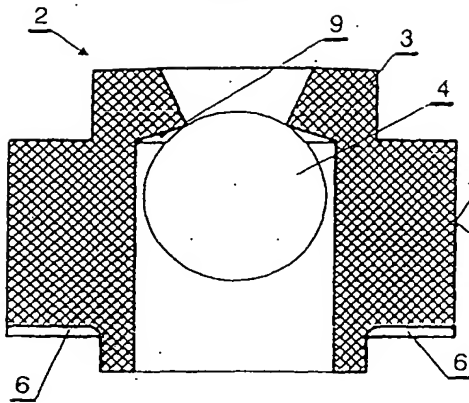


Fig.4

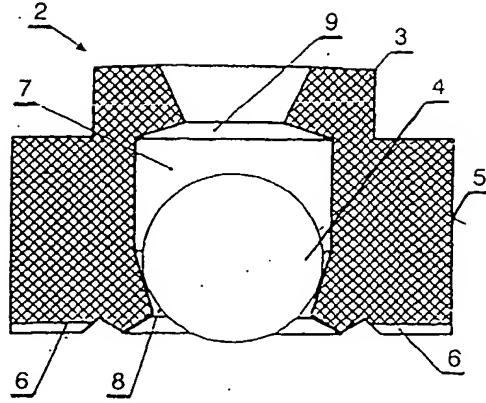


Fig.5

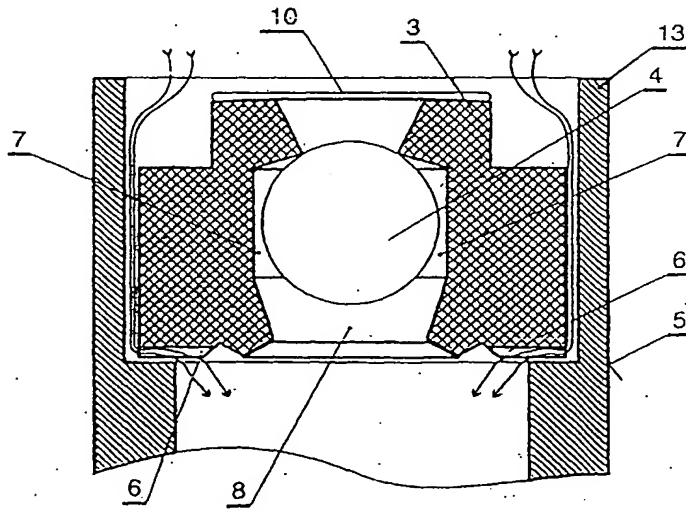
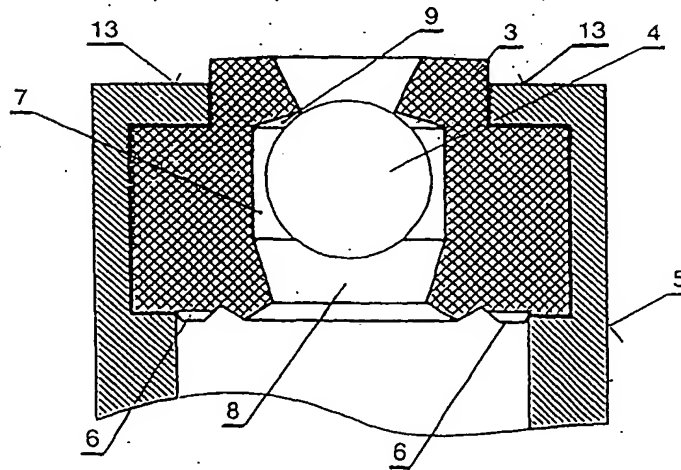
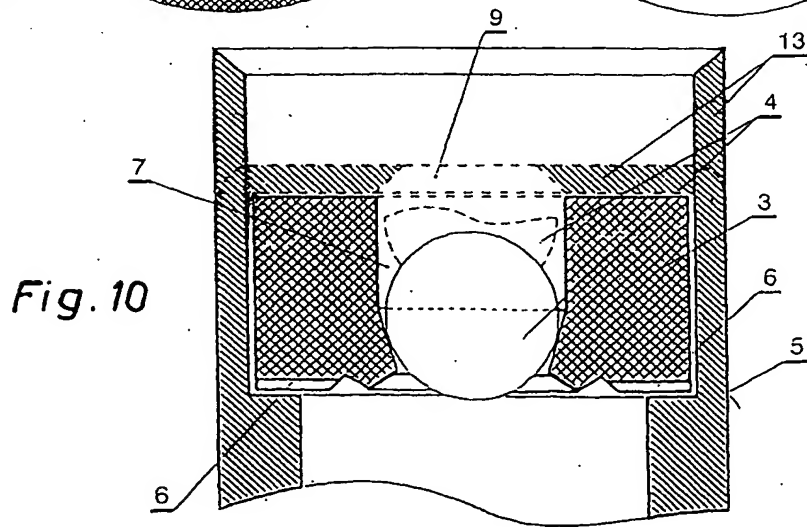
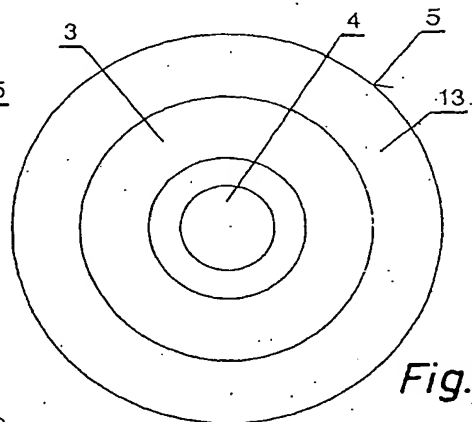
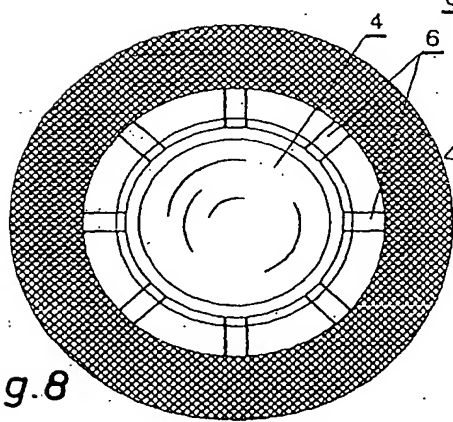
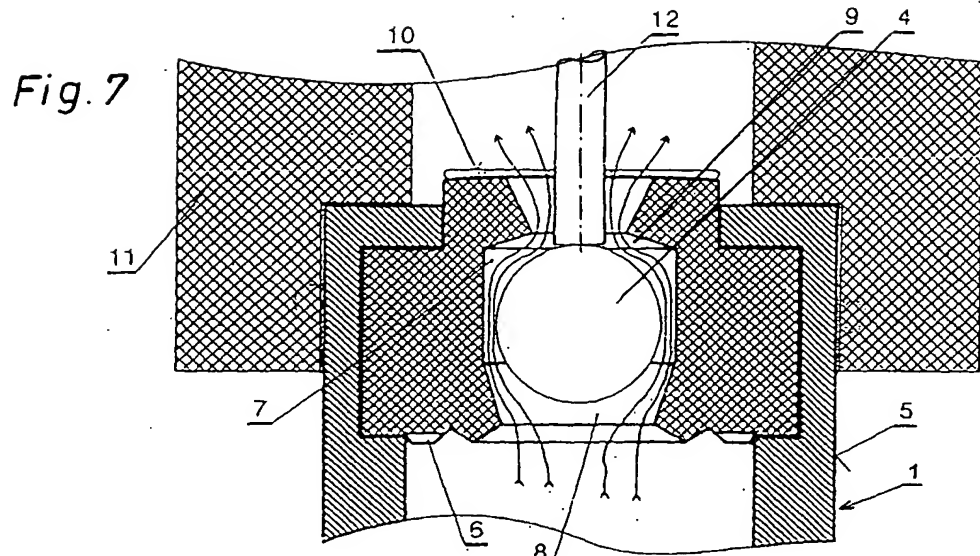


Fig.6





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